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513 7590 05/22/2008

WENDEROTH, LIND & PONACK, L.L.P.
2033 K STREET N. W.
SUITE 800
WASHINGTON, DC 20006-1021

EXAMINER

NGUYEN, LINH V

ART UNIT

PAPER NUMBER

2819

DATE MAILED: 05/22/2008

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/579,630

09/11/2007

Ken-ichi Kitayama

2006_0745A

9178

TITLE OF INVENTION: OPTICAL SIGNAL PROCESSING DEVICE FOR A/D CONVERTER INCLUDING OPTICAL ENCODERS WITH NONLINEAR LOOP MIRRORS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1440	\$300	\$0	\$1740	08/22/2008

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

**Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
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INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

513 7590 05/22/2008

WENDEROTH, LIND & PONACK, L.L.P.
2033 K STREET N. W.
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Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

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I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/579,630 09/11/2007 Ken-ichi Kitayama 2006_0745A 9178

TITLE OF INVENTION: OPTICAL SIGNAL PROCESSING DEVICE FOR A/D CONVERTER INCLUDING OPTICAL ENCODERS WITH NONLINEAR LOOP MIRRORS

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
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nonprovisional NO \$1440 \$300 \$0 \$1740 08/22/2008

EXAMINER	ART UNIT	CLASS-SUBCLASS
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NGUYEN, LINH V 2819 341-137000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

- (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, 1 _____
- (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed. 2 _____
- 3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s); (Please first reapply any previously paid issue fee shown above)

- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. Change in Entity Status (from status indicated above)

- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27. ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____

Date _____

Typed or printed name _____

Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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513	7590	05/22/2008	EXAMINER	
WENDEROTH, LIND & PONACK, L.L.P. 2033 K STREET N. W. SUITE 800 WASHINGTON, DC 20006-1021			NGUYEN, LINH V	
			ART UNIT	PAPER NUMBER
			2819	
DATE MAILED: 05/22/2008				

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b) (application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (<http://pair.uspto.gov>).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

Notice of Allowability

Application No.

10/579,630

Examiner

LINH V. NGUYEN

Applicant(s)

KITAYAMA ET AL.

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2819

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 5/17/06.
2. ☒ The allowed claim(s) is/are 70-90.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☒ None of the:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
* Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.

THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
(a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
(b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.
Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

- | | |
|--|--|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 5. <input type="checkbox"/> Notice of Informal Patent Application |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 6. <input type="checkbox"/> Interview Summary (PTO-413),
Paper No./Mail Date _____. |
| 3. <input checked="" type="checkbox"/> Information Disclosure Statements (PTO/SB/08),
Paper No./Mail Date <u>See Continuation Sheet</u> | 7. <input type="checkbox"/> Examiner's Amendment/Comment |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit
of Biological Material | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
| | 9. <input type="checkbox"/> Other _____. |

Continuation of Attachment(s) 3. Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date: 2/19/08;8/16/06;5/17/06.

DETAILED ACTION

1. This office action is in response to preliminary amendment filed on 5/17/06. Claims 1-69 have been canceled. Claims 70 - 90 have been added. Claims 70-90 are pending on this application.

Priority

2. Acknowledgment is made of applicant's claim for foreign priority based on applications filed in Japan on 11/17/03 and 6/04/2004. It is noted, however, that applicant has not filed a certified copy of the 2003-386898 and 2004-167230 applications as required by 35 U.S.C. 119(b).

Allowable Subject Matter

3. Claims 70-90 are allowed.
4. The following is an examiner's statement of reasons for allowance:

With respect to claims 70 and 73, in addition to other elements in each respective claim, prior art considered individual or combination does not teach an optical signal processing method for optically analog-to-digital- converting an optical analog signal into an optical digital signal, the method including the steps of: using a plurality of optical encoders each including nonlinear optical loop mirrors having input-to-output characteristics with different periodicities with respect to light intensity, and outputting a plurality of pulse trains of optically encoded signal light from said optical encoders, respectively; and performing optical threshold processing on the plurality of pulse trains

of optically-encoded signal light to optically quantize the plurality of pulse trains of optically-encoded signal light, by using at least one of optical threshold processors each of which is connected to each of said optical encoders and includes a nonlinear optical device having a nonlinear input-to-output characteristic with respect to light intensity, and outputting optically quantized pulse trains as optical digital signals.

With respect to claim 76, in addition to other elements in the claim, prior art considered individual or combination does not teach a nonlinear optical loop mirror comprising: wherein said nonlinear optical loop mirror adjusts a phase difference between optical signals inputted to the both ends of said optical fibers according to power of the control light signal so as to control power of the output optical signal outputted from said optical-signal output end, and wherein said nonlinear optical loop mirror suppresses a parametric gain caused among the respective branched optical signals and the control light signal, so that a ratio of the power of the output optical signal to the maximum value thereof becomes equal to or smaller than a predetermined threshold value when a difference between phase shifts caused to the respective branched optical signals is set to $2n\pi$ (where "n" is an integer equal to or larger than 1), where the phase shifts are caused by cross-phase modulation (XPM) generated among the respective branched optical signals and the control light signal.

With respect to claim 85, in addition to other elements in the claim, prior art considered individual or combination does not teach a nonlinear optical loop mirror comprising wherein said nonlinear optical loop mirror adjusts a phase difference between optical signals inputted to the both ends of said optical fibers according to

power of the control light signal so as to control power of the output optical signal outputted from said optical-signal output end, wherein a dispersion characteristic of said nonlinear medium has a normal dispersion characteristic, at a wavelength of the control light signal, and wherein one of the following conditions is set to be satisfied:

- (a) a dispersion value of said nonlinear medium at a wavelength of the control light signal is equal to or smaller than -0.62 ps/nm/km and a wavelength difference between the input signal light and the control light is equal to or larger than 16 nm ; and
- (b) a dispersion value of said nonlinear medium at a wavelength of the control light signal is equal to or smaller than -0.315 ps/nm/km and a wavelength difference between the input signal light and the control light is equal to or larger than 20 nm .

With respect to claim 87, in addition to other elements in the claim, prior art considered individual or combination does not teach a nonlinear optical loop mirror comprising: wherein said nonlinear optical loop mirror adjusts a phase difference between optical signals inputted to the both ends of said optical fibers according to power of the control light signal so as to control power of the output optical signal outputted from said optical-signal output end, wherein a difference between phase shifts caused to the respective optical signals, due to cross-phase modulation (XPM) caused between the respective optical signals and the control light signal, is equal to or larger than 2π , wherein said nonlinear medium has a normal dispersion characteristic, at a wavelength of the control light signal, and wherein said nonlinear optical loop mirror suppresses a parametric gain caused among the respective branched optical signals and the control light signal, so that a ratio of the power of the output optical signal to the

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maximum value thereof becomes equal to or smaller than a threshold value for optical analog-to-digital conversion when a difference between phase shifts caused to the respective branched optical signals is set to $2n\pi$ (where "n" is an integer equal to or larger than 1), where the phase shifts are caused by cross-phase modulation (XPM) generated among the respective branched optical signals and the control light signal.

With respect to claim 89, in addition to other elements in the claim, prior art considered individual or combination does not teach a method for designing a nonlinear optical loop mirror comprising wherein said nonlinear optical loop mirror adjusts a phase difference between optical signals inputted to the both ends of said optical fibers according to power of the control light signal so as to control power of the output optical signal outputted from said optical-signal output end, and wherein the method including the steps of: a first step of determining a transfer function and a period (ϕ_{\max}) of the transfer function, the transfer function being expressed as a relationship of power of an input optical signal with respect to power of an output optical signal; a second step of determining a threshold value of the output optical signal suitable for optical signal processing; a third step of provisionally determining a nonlinearity constant and a dispersion characteristic of said nonlinear medium, and a wavelength and a peak power of the control light signal; a fourth step of judging whether or not a phase shift reaches the period (ϕ_{\max}), and proceeding to a fifth step when the phase shift reaches the period (ϕ_{\max}), while returning to the third step when the phase shift does not reach the period (ϕ_{\max});

With respect to claim 90, in addition to other elements in the claim, prior art considered individual or combination does not teach an optical signal conversion method including the steps changing a phase shift difference between the optical signals (A) and (B) periodically with respect to change in power of the control light signal so as to change power of output optical signal resulted from interference between the optical signals (A) and (B), wherein the method includes the steps of suppressing a parametric gain caused between the optical signal (A) and the control light signal, so that the power of the output optical signal when the phase shift difference is $2n\pi$ (where "n" is an integer equal to or larger than 1) is equal to or smaller than a threshold value for quantization and encoding processing for optical analog-to-digital conversion, with respect to the maximum value of the power of the output optical signal.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Contact Information

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Linh Van Nguyen whose telephone number is (571) 272-1810. The examiner can normally be reached from 8:30 – 5:00 Monday-Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Rexford Barnie can be reached at (571) 272-7492. The

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fax phone numbers for the organization where this application or proceeding is assigned are (571-273-8300) for regular communications and (571-273-8300) for After Final communications.

5/20/08

/Linh V Nguyen/

Primary Examiner, Art Unit 2819